

WHAT IS CLAIMED IS:

1. A restraining device for maintaining a self-expanding medical device on a delivery catheter, comprising:

a restraining sheath having an expandable housing portion adapted to receive and maintain the self-expanding medical device in a collapsed condition on the delivery catheter.

2. The restraining device of claim 1, wherein:

the expandable housing portion is adapted to expand between a contracted position and an expanded position, the housing portion having sufficient column strength to maintain the self-expanding medical device in its collapsed condition on its delivery catheter.

3. The restraining device of claim 2, wherein:

the expandable housing portion is made primarily from an elastic material which is stretchable between the contracted position and expanded position and includes at least one reenforcing member associated therewith for providing additional column strength to the housing portion.

4. The restraining device of claim 3, further including:

a plurality of reenforcing members associated with the expandable housing portion to provide additional column strength to the housing portion.

5. The restraining device of claim 4, wherein:

the reenforcing members extend substantially along the length of the expandable housing portion but do not interfere with the expansion of the elastic material.

6. The restraining device of claim 5, wherein:
the reinforcing members are elongated bar-like members made
from a material having high stiffness.

7. The restraining device of claim 3, wherein:
the elastic material is selected from a group of materials which
includes silicone, polyurethane, polyisoprene, and lower durometer PEBAX.

8. The restraining device of claim 4, wherein:
the reinforcing member is made from a material selected from a
group including stainless steel, polymeric material, and nitinol.

9. The restraining device of claim 8, wherein:
the reinforcing members are loaded with a material having high
radiopacity.

10. The restraining device of claim 1, wherein:
the expandable housing portion is made from a substantially
tubular-shaped material which is highly elastic and includes a plurality of reinforcing
members disposed within the tubular elastic material to provide additional column
strength to the housing portion.

11. The restraining device of claim 4, wherein:
the reinforcing members are disposed within the elastic material
forming the expandable housing portion.

12. The restraining device of claim 4, wherein:
the reinforcing members are attached to the surface of the expandable housing portion.
13. The restraining device of claim 4, wherein:
each reinforcing member is disposed along the expandable housing portion to provide additional column strength to the housing portion but does not interfere with the expansion of the housing portion.
14. The restraining device of claim 2, further including:
coil spring associated with the expandable housing portion which provides column strength to the housing portion and is expandable from the contracted position to the expanded position with the elastic material which forms the housing portion.
15. The restraining device of claim 14, wherein:
the coils of the coil spring extend longitudinally along the length of the expandable housing portion.
16. The restraining device of claim 14, wherein:
the coil spring is made from a material selected from a group including nickel-titanium, spring steel and highly flexible plastic.
17. The restraining device of claim 2, further including:
a ring member disposed near the distal tip of the expandable housing portion.

18. The restraining device of claim 17, wherein:
the ring member has a plurality of undulations and is expandable
with the elastic material which forms the housing portion.

19. The restraining device of claim 18, wherein:
the ring member is made from a material selected from a group
including nickel-titanium, spring steel and highly flexible plastic.

20. The restraining device of claim 2, wherein:
the expandable housing portion includes a low expansion section
with at least one expansion member disposed within the low expansion section to
provide the elasticity needed to move the housing portion between the contracted
position and expanded position.

21. The restraining device of claim 2, wherein:
the expandable housing portion includes a plurality of low
expansion sections and a plurality of expansion members disposed between low
expansion sections.

22. The restraining device of claim 21, wherein:
the low expansion sections are made from a material loaded with
a material having high radiopacity.

23. The restraining device of claim 21, wherein:
the expansion members are made from an elastic material
selected from a group which includes polyurethane, silicone, polyisoprene and lower
durometer PEBAX.

24. The restraining device of claim 23, wherein:
the low expansion sections are made from a material selected from a group including cross-linked HDPE, polyolefin and polyamide.
25. The restraining device of claim 21, wherein:
the expansion members extend longitudinally along the length of the expandable housing portion.
26. The restraining device of claim 25, wherein:
the expansion members include means for preventing the low expansion sections from tearing as the expandable housing portion expands from the contracted position to the expanded position.
27. The restraining device of claim 2, wherein:
the expandable housing portion includes a distal tip section made from highly elastic material which is expandable and contractable between a contracted position and expanded position.
28. The restraining device of claim 27, wherein:
the distal tip section is made from a more elastic material than the remaining portion of the expandable housing portion.
29. The restraining device of claim 28, further including:
an expandable ring member associated with the distal tip section which is expandable between the contracted position and expanded position and is normally biased to the contracted position.

30. The restraining device of claim 29, wherein:
the ring member is encapsulated within the material forming the
distal tip section.

31. The restraining device of claim 29, wherein:
the ring member is attached to the outer surface of the distal tip
section.

32. The restraining device of claim 29, wherein:
the ring member is made from materials selected from a group
including nickel-titanium, stainless steel and highly elastic plastic.

33. A recovery device for retrieving from a body vessel a deployed
embolic filtering device which includes an expandable filter basket mounted on a
guide wire, the recovery device comprising:

a recovery sheath having a lumen extending therethrough which
is coaxially mounted on the guide wire of the filtering device, the recovery sheath
having a distal end which is adapted to contact the filter basket to collapse the filter
basket; and

an inner recovery tip coaxially mounted on the guide wire, a
portion of the inner recovery tip disposed within the lumen of the recovery sheath and
a distal portion of the inner recovery tip extending distally from the distal tip of the
recovery sheath as the recovery sheath and inner recovery tip move simultaneously
along the guide wire.

34. The recovery device of claim 33, wherein:
the inner recovery tip is slidable within the lumen of the recovery
sheath after a certain amount of force is applied to the inner recovery tip.

35. The recovery device of claim 33, wherein:
the inner recovery tip engages the inner surface of the lumen of
the recovery sheath to maintain a frictional fit therebetween which is overcome upon
application of a certain external force to the inner recovery tip.

36. The recovery device of claim 33, wherein:
the inner recovery tip is in contact with the recovery sheath to
maintain a frictional fit therebetween.

37. The recovery device of claim 33, wherein:
the lumen of the recovery sheath defines a surface which contacts
the surface of the inner recovery tip to maintain a frictional fit therebetween.

38. The recovery device of claim 37, further including:
a mechanism for enhancing the frictional fit between the inner
recovery tip and the recovery sheath.

39. The recovery device of claim 38, wherein:
the mechanism includes a plurality of rib-like projections
disposed on the surface of the recovery sheath which contact a plurality of rib-like
projections on the surface of the inner recovery tip.

40. The recovery device of claim 39, wherein:
the ribs of the recovery sheath are maintained in an
interconnected relationship with the ribs of the inner recovery tip until a certain
amount of force is applied to the inner recovery tip which causes the inner recovery
tip to move within the lumen of the recovery sheath.